



## General

### Guideline Title

Guidelines for the prevention of intravascular catheter-related infections, 2011.

### Bibliographic Source(s)

O'Grady NP, Alexander M, Burns LA, Dellinger EP, Garland J, Heard SO, Lipsett PA, Masur H, Mermel LA, Pearson ML, Raad II, Randolph A, Rupp ME, Saint S, Healthcare Infection Control Practices Advisory Committee (HICPAC). Guidelines for the prevention of intravascular catheter-related infections, 2011. Atlanta (GA): Centers for Disease Control and Prevention (CDC); 2011. 83 p. [370 references]

### Guideline Status

This is the current release of the guideline.

This guideline updates a previously released version: O'Grady NP, Alexander M, Dellinger EP, Gerberding JL, Heard SO, Maki DG, Masur H, McCormick RD, Mermel LA, Pearson ML, Raad II, Randolph A, Weinstein RA. Guidelines for the prevention of intravascular catheter-related infections [published erratum appears in MMWR Weekly 2002 Aug 16;51(32):71]. MMWR Recomm Rep 2002 Aug 9;51(RR-10):1-29.

## Recommendations

### Major Recommendations

Definitions for the categories of the recommendations (IA-II, Unresolved issue) are provided at the end of the "Major Recommendations" field.

#### Education, Training, and Staffing

1. Educate healthcare personnel regarding the indications for intravascular catheter use, proper procedures for the insertion and maintenance of intravascular catheters, and appropriate infection control measures to prevent intravascular catheter-related infections (Yoo et al., 2001; Warren et al., 2003; Warren et al., 2004; Warren et al., 2006; Higuera et al., 2005; Coopersmith et al., 2002; Coopersmith et al., 2004; Sherertz et al., 2000; Eggimann et al., 2000). Category IA
2. Periodically assess knowledge of and adherence to guidelines for all personnel involved in the insertion and maintenance of intravascular catheters (Yoo et al., 2001; Warren et al., 2003; Warren et al., 2004; Warren et al., 2006; Higuera et al., 2005; Coopersmith et al., 2002; Coopersmith et al., 2004; Sherertz et al., 2000; Eggimann et al., 2000). Category IA
3. Designate only trained personnel who demonstrate competence for the insertion and maintenance of peripheral and central intravascular catheters (Sherertz et al., 2000; Eggimann et al., 2000; Nehme, 1980; Soifer et al., 1998; Tomford et al., 1984; Scalley, Van, & Cochran, 1992; Palefski & Stoddard, 2001; Miller et al., 1996; Hunter, 2003; Hawes, 2007; Brunelle, 2003; Bosma & Jewesson, 2002; Pierce & Baker, 2004; Tomford & Hershey, 1985; Davis et al., 1999). Category IA

4. Ensure appropriate nursing staff levels in intensive care units (ICUs). Observational studies suggest that a higher proportion of "pool nurses" or an elevated patient-to-nurse ratio is associated with catheter-related bloodstream infections (CRBSIs) in ICUs where nurses are managing patients with central venous catheters (CVCs) (Alonso-Echanove et al., 2003; Fridkin et al., 1996; Robert et al., 2000).

Category IB

#### Selection of Catheters and Sites

##### *Peripheral Catheters and Midline Catheters*

1. In adults, use an upper-extremity site for catheter insertion. Replace a catheter inserted in a lower extremity site to an upper extremity site as soon as possible. Category II
2. In pediatric patients, the upper or lower extremities or the scalp (in neonates or young infants) can be used as the catheter insertion site (Maki, Goldman, & Rhame, 1973; Band & Maki, 1980). Category II
3. Select catheters on the basis of the intended purpose and duration of use, known infectious and non-infectious complications (e.g., phlebitis and infiltration), and experience of individual catheter operators (Band & Maki, 1980; Tully et al., 1981; Ryder, 1995). Category IB
4. Avoid the use of steel needles for the administration of fluids and medication that might cause tissue necrosis if extravasation occurs (Band & Maki, 1980; Tully et al., 1981). Category IA
5. Use a midline catheter or peripherally inserted central catheter (PICC), instead of a short peripheral catheter, when the duration of intravenous (IV) therapy will likely exceed six days. Category II
6. Evaluate the catheter insertion site daily by palpation through the dressing to discern tenderness and by inspection if a transparent dressing is in use. Gauze and opaque dressings should not be removed if the patient has no clinical signs of infection. If the patient has local tenderness or other signs of possible CRBSI, an opaque dressing should be removed and the site inspected visually. Category II
7. Remove peripheral venous catheters if the patient develops signs of phlebitis (warmth, tenderness, erythema or palpable venous cord), infection, or a malfunctioning catheter (Maki & Ringer, 1991). Category IB

##### *Central Venous Catheters*

1. Weigh the risks and benefits of placing a central venous device at a recommended site to reduce infectious complications against the risk for mechanical complications (e.g., pneumothorax, subclavian artery puncture, subclavian vein laceration, subclavian vein stenosis, hemothorax, thrombosis, air embolism, and catheter misplacement) (Mermel et al., 1991; Parienti et al., 2008; Moretti et al., 2005; Nagashima et al., 2006; Ruesch, Walder, & Tramer, 2002; Sadoyama & Gontijo Filho, 2003; Heard et al., 1998; Richet et al., 1990; Safdar, Kluger, & Maki, 2002; Lorente et al., 2006; Traore, Liotier, & Souweine, 2005; Joynt et al., 2000; Mian et al., 1997; Merrer et al., 2001; Goetz et al., 1998; Robinson et al., 1995; Trottier et al., 1995). Category IA
2. Avoid using the femoral vein for central venous access in adult patients (Parienti et al., 2008; Merrer et al., 2001; Goetz et al., 1998; Lorente et al., 2005). Category 1A
3. Use a subclavian site, rather than a jugular or a femoral site, in adult patients to minimize infection risk for nontunneled CVC placement (Merrer et al., 2001; Goetz et al., 1998; Robinson et al., 1995). Category IB
4. No recommendation can be made for a preferred site of insertion to minimize infection risk for a tunneled CVC. Unresolved issue
5. Avoid the subclavian site in hemodialysis patients and patients with advanced kidney disease, to avoid subclavian vein stenosis (Trottier et al., 1995; Schillinger et al., 1991; Cimochowski et al., 1990; Barrett et al., 1988; Trerotola et al., 2000). Category IA
6. Use a fistula or graft in patients with chronic renal failure instead of a CVC for permanent access for dialysis ("III. NKF-K/DOQI clinical practice guidelines," 2001). Category 1A
7. Use ultrasound guidance to place central venous catheters (if this technology is available) to reduce the number of cannulation attempts and mechanical complications. Ultrasound guidance should only be used by those fully trained in its technique (Hind et al., 2003; Randolph et al., 1996; Froehlich et al., 2009; Lamperti et al., 2008; Schweickert et al., 2009). Category 1B
8. Use a CVC with the minimum number of ports or lumens essential for the management of the patient (Clark-Christoff et al., 1992; Early et al., 1990; Hilton et al., 1988; Yeung, May, & Hughes, 1988). Category IB
9. No recommendation can be made regarding the use of a designated lumen for parenteral nutrition. Unresolved issue
10. Promptly remove any intravascular catheter that is no longer essential (Pronovost et al., 2006; Berenholtz et al., 2004; Lederle et al., 1992; Parienti et al., 1994). Category IA
11. When adherence to aseptic technique cannot be ensured (i.e., catheters inserted during a medical emergency), replace the catheter as soon as possible, i.e., within 48 hours (Mermel et al., 1991; Abi-Said et al., 1999; Capdevila, Segarra, & Pahissa, 1998; Mermel & Maki, 1994; Raad et al., 1994). Category IB

#### Hand Hygiene and Aseptic Technique

1. Perform hand hygiene procedures, either by washing hands with conventional soap and water or with alcohol-based hand rubs (ABHR).

Hand hygiene should be performed before and after palpating catheter insertion sites, as well as before and after inserting, replacing, accessing, repairing, or dressing an intravascular catheter. Palpation of the insertion site should not be performed after the application of antiseptic, unless aseptic technique is maintained (Coopersmith et al., 2002; Boyce & Pittet, 2002; Bischoff et al., 2000; Pittet et al., 1999). Category IB

2. Maintain aseptic technique for the insertion and care of intravascular catheters (Mermel et al., 1991; Abi-Said et al., 1999; Capdevila, Segarra, & Pahissa, 1998; Raad et al., 1994). Category IB
3. Wear clean, rather than sterile gloves, for the insertion of peripheral intravascular catheters, if the access site is not touched after the application of skin antiseptics. Category IC
4. Sterile gloves should be worn for the insertion of arterial, central, and midline catheters (Mermel et al., 1991; Abi-Said et al., 1999; Capdevila, Segarra, & Pahissa, 1998; Raad et al., 1994). Category IA
5. Use new sterile gloves before handling the new catheter when guidewire exchanges are performed. Category II
6. Wear either clean or sterile gloves when changing the dressing on intravascular catheters. Category IC

#### Maximal Sterile Barrier Precautions

1. Use maximal sterile barrier precautions, including the use of a cap, mask, sterile gown, sterile gloves, and a sterile full body drape, for the insertion of CVCs, PICCs, or guidewire exchange (Sheretz et al., 2000; Mermel & Maki, 1994; Raad et al., 1994; Carrer et al., 2005). Category IB
2. Use a sterile sleeve to protect pulmonary artery catheters during insertion (Cohen et al., 1998). Category IB

#### Skin Preparation

1. Prepare clean skin with an antiseptic (70% alcohol, tincture of iodine, or alcoholic chlorhexidine gluconate solution) before peripheral venous catheter insertion (Maki, Ringer, & Alvarado, 1991). Category IB
2. Prepare clean skin with a >0.5% chlorhexidine preparation with alcohol before central venous catheter and peripheral arterial catheter insertion and during dressing changes. If there is a contraindication to chlorhexidine, tincture of iodine, an iodophor, or 70% alcohol can be used as alternatives (Maki, Ringer, & Alvarado, 1991; Mimoz et al., 1996). Category IA
3. No comparison has been made between using chlorhexidine preparations with alcohol and povidone-iodine in alcohol to prepare clean skin. Unresolved issue
4. No recommendation can be made for the safety or efficacy of chlorhexidine in infants aged <2 months. Unresolved issue
5. Antiseptics should be allowed to dry according to the manufacturer's recommendation prior to placing the catheter (Maki, Ringer, & Alvarado, 1991; Mimoz et al., 1996). Category IB

#### Catheter Site Dressing Regimens

1. Use either sterile gauze or sterile, transparent, semipermeable dressing to cover the catheter site (Maki et al., 1994; Bijma et al., 1999; Madeo et al., 1998; Laura et al., 2000). Category IA
2. If the patient is diaphoretic or if the site is bleeding or oozing, use a gauze dressing until this is resolved (Maki et al., 1994; Bijma et al., 1999; Madeo et al., 1998; Laura et al., 2000). Category II
3. Replace catheter site dressing if the dressing becomes damp, loosened, or visibly soiled (Maki et al., 1994; Bijma et al., 1999). Category IB
4. Do not use topical antibiotic ointment or creams on insertion sites, except for dialysis catheters, because of their potential to promote fungal infections and antimicrobial resistance (Zakrzewska-Bode et al., 1995; Flowers et al., 1989). Category IB
5. Do not submerge the catheter or catheter site in water. Showering should be permitted if precautions can be taken to reduce the likelihood of introducing organisms into the catheter (e.g., if the catheter and connecting device are protected with an impermeable cover during the shower) (Robbins, Cromwell, & Korones, 1999; Howell et al., 1995; Ivy et al., 2009). Category IB
6. Replace dressings used on short-term CVC sites every 2 days for gauze dressings. Category II
7. Replace dressings used on short-term CVC sites at least every 7 days for transparent dressings, except in those pediatric patients in which the risk for dislodging the catheter may outweigh the benefit of changing the dressing (Laura et al., 2000; Timsit et al., 2009). Category IB
8. Replace transparent dressings used on tunneled or implanted CVC sites no more than once per week (unless the dressing is soiled or loose), until the insertion site has healed. Category II
9. No recommendation can be made regarding the necessity for any dressing on well-healed exit sites of long-term cuffed and tunneled CVCs. Unresolved issue
10. Ensure that catheter site care is compatible with the catheter material (Rao & Oreopoulos, 1997; Riu et al., 1998). Category IB
11. Use a sterile sleeve for all pulmonary artery catheters (Cohen et al., 1998). Category IB
12. Use a chlorhexidine-impregnated sponge dressing for temporary short-term catheters in patients older than 2 months of age if the central

line-associated bloodstream infection (CLABSI) rate is not decreasing despite adherence to basic prevention measures, including education and training, appropriate use of chlorhexidine for skin antisepsis, and maximum sterile barrier (MSB) (Timsit et al., 2009; Garland et al., 2001; Ho & Litton, 2006; Levy et al., 2005). Category 1B

13. No recommendation is made for other types of chlorhexidine dressings. Unresolved issue
14. Monitor the catheter sites visually when changing the dressing or by palpation through an intact dressing on a regular basis, depending on the clinical situation of the individual patient. If patients have tenderness at the insertion site, fever without obvious source, or other manifestations suggesting local or bloodstream infection, the dressing should be removed to allow thorough examination of the site (Lorenzen & Itkin, 1992; White, 1992; White & Ragland, 1994). Category IB
15. Encourage patients to report any changes in their catheter site or any new discomfort to their provider. Category II

#### Patient Cleansing

Use a 2% chlorhexidine wash for daily skin cleansing to reduce CRBSI (Bleasdale et al., 2007; Munoz-Price et al., 2009; Popovich et al., 2009). Category II

#### Catheter Securement Devices

Use a sutureless securement device to reduce the risk of infection for intravascular catheters (Yamamoto et al., 2002). Category II

#### Antimicrobial/Antiseptic Impregnated Catheters and Cuffs

Use a chlorhexidine/silver sulfadiazine or minocycline/rifampin-impregnated CVC in patients whose catheter is expected to remain in place >5 days if, after successful implementation of a comprehensive strategy to reduce rates of CLABSI, the CLABSI rate is not decreasing. The comprehensive strategy should include at least the following three components: educating persons who insert and maintain catheters, use of maximal sterile barrier precautions, and a >0.5% chlorhexidine preparation with alcohol for skin antisepsis during CVC insertion (Brun-Buisson et al., 2004; Ostendorf et al., 2005; Rupp et al., 2005; Darouiche et al., 1999; Raad et al., 1997; Hanna et al., 2004; Bhutta et al., 2007; Chelliah et al., 2007). Category IA

#### Systemic Antibiotic Prophylaxis

Do not administer systemic antimicrobial prophylaxis routinely before insertion or during use of an intravascular catheter to prevent catheter colonization or CRBSI (van de Wetering & van Woensel, 2007). Category IB

#### Antibiotic/Antiseptic Ointments

Use povidone iodine antiseptic ointment or bacitracin/gramicidin/polymyxin B ointment at the hemodialysis catheter exit site after catheter insertion and at the end of each dialysis session only if this ointment does not interact with the material of the hemodialysis catheter per manufacturer's recommendation ("III. NKF-K/DOQI clinical practice guidelines," 2001; Maki & Band, 1981; Fukunaga et al., 2004; Johnson et al., 2002; Fong, 1993; Levin et al., 1991). Category IB

#### Antibiotic Lock Prophylaxis, Antimicrobial Catheter Flush and Catheter Lock Prophylaxis

Use prophylactic antimicrobial lock solution in patients with long term catheters who have a history of multiple CRBSI despite optimal maximal adherence to aseptic technique (Schwartz et al., 1990; Rackoff et al., 1995; Carratala et al., 1999; Jurewitsch et al., 1998; Henrickson et al., 2000; Garland et al., 2005; Daghastani et al., 1996; Barriga et al., 1997; Dogra et al., 2002; Allon, 2003; Elhassan et al., 2004; McIntyre et al., 2004; Betjes & van Agteren, 2004; Weijmer et al., 2005; Bleyer et al., 2005; Kim et al., 2006; Al-Hwiesh & Abdul-Rahman, 2007; Nori et al., 2006; Saxena et al., 2006). Category II

#### Anticoagulants

Do not routinely use anticoagulant therapy to reduce the risk of catheter-related infection in general patient populations (Randolph et al., 1998). Category II

#### Replacement of Peripheral and Midline Catheters

1. There is no need to replace peripheral catheters more frequently than every 72-96 hours to reduce risk of infection and phlebitis in adults (Maki & Ringer, 1991; Tager et al., 1983; Lai, 1998). Category 1B
2. No recommendation is made regarding replacement of peripheral catheters in adults only when clinically indicated (Van Donk et al., 2009; Webster et al., 2008; Webster et al., 2010). Unresolved issue
3. Replace peripheral catheters in children only when clinically indicated (Maki, Goldman, & Rhame, 1973; Band & Maki, 1980). Category

1B

4. Replace midline catheters only when there is a specific indication. Category II

#### Replacement of CVCs, Including PICCs and Hemodialysis Catheters

1. Do not routinely replace CVCs, PICCs, hemodialysis catheters, or pulmonary artery catheters to prevent catheter-related infections. Category IB
2. Do not remove CVCs or PICCs on the basis of fever alone. Use clinical judgment regarding the appropriateness of removing the catheter if infection is evidenced elsewhere or if a noninfectious cause of fever is suspected. Category II
3. Do not use guidewire exchanges routinely for non-tunneled catheters to prevent infection. Category IB
4. Do not use guidewire exchanges to replace a non-tunneled catheter suspected of infection. Category IB
5. Use a guidewire exchange to replace a malfunctioning non-tunneled catheter if no evidence of infection is present. Category IB
6. Use new sterile gloves before handling the new catheter when guidewire exchanges are performed. Category II

#### Umbilical Catheters

1. Remove and do not replace umbilical artery catheters if any signs of CRBSI, vascular insufficiency in the lower extremities, or thrombosis are present (Boo et al., 1999). Category II
2. Remove and do not replace umbilical venous catheters if any signs of CRBSI or thrombosis are present (Boo et al., 1999). Category II
3. No recommendation can be made regarding attempts to salvage an umbilical catheter by administering antibiotic treatment through the catheter. Unresolved issue
4. Cleanse the umbilical insertion site with an antiseptic before catheter insertion. Avoid tincture of iodine because of the potential effect on the neonatal thyroid. Other iodine-containing products (e.g., povidone iodine) can be used (Garland et al., 1995; Krauss, Albert, & Kannan, 1970; Landers et al., 1991; Cronin, Germanson, & Donowitz, 1990; Miller et al., 1989). Category IB
5. Do not use topical antibiotic ointment or creams on umbilical catheter insertion sites because of the potential to promote fungal infections and antimicrobial resistance (Zakrzewska-Bode et al., 1995; Flowers et al., 1989). Category IA
6. Add low-doses of heparin (0.25—1.0 U/ml) to the fluid infused through umbilical arterial catheters (Ankola & Atakent, 1993; David et al., 1981; Horgan et al., 1987). Category IB
7. Remove umbilical catheters as soon as possible when no longer needed or when any sign of vascular insufficiency to the lower extremities is observed. Optimally, umbilical artery catheters should not be left in place >5 days (Boo et al., 1999; Fletcher et al., 1994). Category II
8. Umbilical venous catheters should be removed as soon as possible when no longer needed, but can be used up to 14 days if managed aseptically (Seguin et al., 1994; Loisel et al., 1996). Category II
9. An umbilical catheter may be replaced if it is malfunctioning, and there is no other indication for catheter removal, and the total duration of catheterization has not exceeded 5 days for an umbilical artery catheter or 14 days for an umbilical vein catheter. Category II

#### Peripheral Arterial Catheters and Pressure Monitoring Devices for Adult and Pediatric Patients

1. In adults, use of the radial, brachial, or dorsalis pedis sites is preferred over the femoral or axillary sites of insertion to reduce the risk of infection (Lorente et al., 2006; Traore, Liotier, & Souweine, 2006; Martin et al., 2001; Koh et al., 2008). Category IB
2. In children, the brachial site should not be used. The radial, dorsalis pedis, and posterior tibial sites are preferred over the femoral or axillary sites of insertion (Lorente et al., 2006). Category II
3. A minimum of a cap, mask, sterile gloves and a small sterile fenestrated drape should be used during peripheral arterial catheter insertion (Traore, Liotier, & Souweine, 2005; Koh et al., 2008; Rijnders et al., 2003). Category IB
4. During axillary or femoral artery catheter insertion, maximal sterile barriers precautions should be used. Category II
5. Replace arterial catheters only when there is a clinical indication. Category II
6. Remove the arterial catheter as soon as it is no longer needed. Category II
7. Use disposable, rather than reusable, transducer assemblies when possible (Donowitz et al., 1979; Luskin et al., 1986; Maki & Hassemer, 1981; Mermel & Maki, 1989; Tenold et al., 1987). Category IB
8. Do not routinely replace arterial catheters to prevent catheter-related infections (Eyer et al., 1990; Raad et al., 1993; Thomas et al., 1983; Leroy et al., 1989). Category II
9. Replace disposable or reusable transducers at 96-hour intervals. Replace other components of the system (including the tubing, continuous-flush device, and flush solution) at the time the transducer is replaced (Mermel et al., 1991; Luskin et al., 1986). Category IB
10. Keep all components of the pressure monitoring system (including calibration devices and flush solution) sterile (Donowitz et al., 1979; Fisher et al., 1981; Stamm et al., 1975; Weinstein et al., 1976). Category IA
11. Minimize the number of manipulations of and entries into the pressure monitoring system. Use a closed flush system (i.e., continuous flush), rather than an open system (i.e., one that requires a syringe and stopcock), to maintain the patency of the pressure monitoring catheters

- (Mermel & Maki, 1989; Shinozaki et al., 1983). Category II
12. When the pressure monitoring system is accessed through a diaphragm, rather than a stopcock, scrub the diaphragm with an appropriate antiseptic before accessing the system (Mermel & Maki, 1989). Category IA
  13. Do not administer dextrose-containing solutions or parenteral nutrition fluids through the pressure monitoring circuit (Mermel & Maki, 1989; Solomon et al., 1986; Weems et al., 1987). Category IA
  14. Sterilize reusable transducers according to the manufacturers' instructions if the use of disposable transducers is not feasible (Mermel & Maki, 1989; Solomon et al., 1986; Weems et al., 1987; Villarino et al., 1989; Beck-Sague et al., 1990). Category IA

#### Replacement of Administration Sets

1. In patients not receiving blood, blood products or fat emulsions, replace administration sets that are continuously used, including secondary sets and add-on devices, no more frequently than at 96-hour intervals, (Gillies et al., 2005) but at least every 7 days (Sitges-Serra et al., 1985; Snydman et al., 1987; Maki et al., 1987; Josephson et al., 1985). Category IA
2. No recommendation can be made regarding the frequency for replacing intermittently used administration sets. Unresolved issue
3. No recommendation can be made regarding the frequency for replacing needles to access implantable ports. Unresolved issue
4. Replace tubing used to administer blood, blood products, or fat emulsions (those combined with amino acids and glucose in a 3-in-1 admixture or infused separately) within 24 hours of initiating the infusion (Melly, Meng, & Schaffner, 1975; Mershon et al., 1986; Gilbert et al., 1986; Maki & Martin, 1975). Category IB
5. Replace tubing used to administer propofol infusions every 6 or 12 hours, when the vial is changed, per the manufacturer's recommendation (Bennett et al., 1995). Category IA
6. No recommendation can be made regarding the length of time a needle used to access implanted ports can remain in place. Unresolved issue

#### Needleless Intravascular Catheter Systems

1. Change the needleless components at least as frequently as the administration set. There is no benefit to changing these more frequently than every 72 hours (Moretti et al., 2005; Arduino et al., 1997; Brown, Moss, & Elliott, 1997; Cookson et al., 1998; Seymour et al., 2000; Luebke et al., 1998; McDonald, Banerjee, & Jarvis, 1998; Mendelson et al., 1998). Category II
2. Change needleless connectors no more frequently than every 72 hours or according to manufacturers' recommendations for the purpose of reducing infection rates (Arduino et al., 1997; Cookson et al., 1998; McDonald, Banerjee, & Jarvis, 1998; Mendelson et al., 1998). Category II
3. Ensure that all components of the system are compatible to minimize leaks and breaks in the system (Do et al., 1999). Category II
4. Minimize contamination risk by scrubbing the access port with an appropriate antiseptic (chlorhexidine, povidone iodine, an iodophor, or 70% alcohol) and accessing the port only with sterile devices (Cookson et al., 1998; McDonald, Banerjee, & Jarvis, 1998; Do et al., 1999; Soothill et al., 2009; Casey et al., 2007). Category IA
5. Use a needleless system to access IV tubing. Category IC
6. When needleless systems are used, a split septum valve may be preferred over some mechanical valves due to increased risk of infection with the mechanical valves (Rupp et al., 2007; Salgado et al., 2007; Maragakis et al., 2006; Field et al., 2007). Category II

#### Performance Improvement

Use hospital-specific or collaborative-based performance improvement initiatives in which multifaceted strategies are "bundled" together to improve compliance with evidence-based recommended practices (Eggimann et al., 2000; Pronovost et al., 2006; Berenholtz et al., 2004; Costello et al., 2008; Frankel et al., 2005; Galpern et al., 2008; McKee et al., 2008; Pronovost, Berenholtz, & Goeschel, 2008). Category IB

#### Definitions:

##### Recommendations Grading Scheme

*Category IA.* Strongly recommended for implementation and strongly supported by well-designed experimental, clinical, or epidemiologic studies

*Category IB.* Strongly recommended for implementation and supported by some experimental, clinical, or epidemiologic studies and a strong theoretical rationale; or an accepted practice (e.g., aseptic technique) supported by limited evidence

*Category IC.* Required by state or federal regulations, rules, or standards

*Category II.* Suggested for implementation and supported by suggestive clinical or epidemiologic studies or a theoretical rationale

*Unresolved Issue.* Represents an unresolved issue for which evidence is insufficient or no consensus regarding efficacy exists

## Clinical Algorithm(s)

None provided

## Scope

### Disease/Condition(s)

Catheter-related bloodstream infections (CRBSI)

### Guideline Category

Prevention

### Clinical Specialty

Anesthesiology

Cardiology

Critical Care

Infectious Diseases

Internal Medicine

Nursing

Oncology

Pediatrics

Preventive Medicine

Pulmonary Medicine

Radiation Oncology

Surgery

### Intended Users

Advanced Practice Nurses

Allied Health Personnel

Health Care Providers

Hospitals

Nurses

Physician Assistants

Physicians

## Guideline Objective(s)

To provide evidence-based recommendations for preventing intravascular catheter-related infections

## Target Population

Adults and children requiring the placement of intravascular catheters

## Interventions and Practices Considered

Strategies for Prevention of Catheter-related Infections

1. Education and training of staff
2. Selection of site for catheter insertion
3. Selection of catheter based on intended purpose, duration of use, known complications, and experience of catheter operator
4. Hand hygiene and aseptic technique during catheter insertion
5. Sterile barrier precautions
6. Skin preparation with chlorhexidine, tincture of iodine, or 70% alcohol
7. Catheter site dressing regimens
8. Patient cleansing with 2% chlorhexidine wash
9. Use of catheter securement devices
10. Use of antimicrobial/antiseptic impregnated catheters and cuffs
11. Systemic antibiotic prophylaxis (considered but not recommended routinely)
12. Application of antibiotic/antiseptic ointment (e.g., povidone-iodine, bacitracin/gramicidin/polymyxin B) to catheter site
13. Antibiotic lock prophylaxis
14. Anticoagulant (considered but not recommended in general patient population)
15. Scheduled replacement of catheters
16. Special considerations for umbilical catheters and peripheral arterial catheters and pressure monitoring devices
17. Replacement of administration sets
18. Use of needleless infusion systems

## Major Outcomes Considered

- Incidence of and risk for intravascular catheter-related infection and phlebitis
- Morbidity and mortality due to intravascular catheter-related infections
- Healthcare costs associated with intravascular catheter-related infections

## Methodology

### Methods Used to Collect/Select the Evidence

Searches of Electronic Databases

### Description of Methods Used to Collect/Select the Evidence

Medline and PubMed were searched from 2000 to 2009 using the terms *Catheter-Related Infections, prevention, Catheterization, Central Venous/adverse effects, methods, standards, Catheterization, Peripheral/adverse effects Catheterization, Peripheral/methods Catheterization, peripheral/standards, Handwashing/standards*. The committee focused on human studies published in the English language.

## Number of Source Documents

Not stated

## Methods Used to Assess the Quality and Strength of the Evidence

Not stated

## Rating Scheme for the Strength of the Evidence

Not applicable

## Methods Used to Analyze the Evidence

Review of Published Meta-Analyses

Systematic Review

## Description of the Methods Used to Analyze the Evidence

Not stated

## Methods Used to Formulate the Recommendations

Expert Consensus

## Description of Methods Used to Formulate the Recommendations

This report was prepared by a working group comprising members from professional organizations representing the disciplines of critical care medicine, infectious diseases, healthcare infection control, surgery, anesthesiology, interventional radiology, pulmonary medicine, pediatric medicine, and nursing. The working group was led by the Society of Critical Care Medicine (SCCM), in collaboration with the Infectious Diseases Society of America (IDSA), Society for Healthcare Epidemiology of America (SHEA), Surgical Infection Society (SIS), American College of Chest Physicians (ACCP), American Thoracic Society (ATS), American Society of Critical Care Anesthesiologists (ASCCA), Association for Professionals in Infection Control and Epidemiology (APIC), Infusion Nurses Society (INS), Oncology Nursing Society (ONS), American Society for Parenteral and Enteral Nutrition (ASPEN), Society of Interventional Radiology (SIR), American Academy of Pediatrics (AAP), Pediatric Infectious Diseases Society (PIDS), and the Healthcare Infection Control Practices Advisory Committee (HICPAC) of the Centers for Disease Control and Prevention (CDC) and is intended to replace the Guideline for Prevention of Intravascular Catheter-Related Infections published in 2002.

## Rating Scheme for the Strength of the Recommendations

Recommendations Grading Scheme

*Category IA.* Strongly recommended for implementation and strongly supported by well-designed experimental, clinical, or epidemiologic studies

*Category IB.* Strongly recommended for implementation and supported by some experimental, clinical, or epidemiologic studies and a strong theoretical rationale; or an accepted practice (e.g., aseptic technique) supported by limited evidence

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*Category II.* Suggested for implementation and supported by suggestive clinical or epidemiologic studies or a theoretical rationale

*Unresolved Issue.* Represents an unresolved issue for which evidence is insufficient or no consensus regarding efficacy exists

## Cost Analysis

Guideline developers reviewed published cost analyses.

## Method of Guideline Validation

Peer Review

## Description of Method of Guideline Validation

Not stated

## Evidence Supporting the Recommendations

### References Supporting the Recommendations

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## Type of Evidence Supporting the Recommendations

The type of supporting evidence is identified and graded for each recommendation (see the "Major Recommendations" field).

As in previous guidelines issued by the Centers for Disease Control and Prevention (CDC) and the Healthcare Infection Control Practices Advisory Committee (HICPAC), each recommendation is categorized on the basis of existing scientific data, theoretical rationale, applicability, and economic impact.

## Benefits/Harms of Implementing the Guideline Recommendations

### Potential Benefits

Improved patient outcomes and decreased health-care costs by reducing the infectious complications associated with intravascular catheter use

### Potential Harms

Although most studies indicate a beneficial effect of the *antimicrobial flush* or *lock solution* in terms of prevention of catheter-related infection,

this must be balanced by the potential for side effects, toxicity, allergic reactions, or emergence of resistance associated with the antimicrobial agent.

## Qualifying Statements

### Qualifying Statements

Use of trade names and commercial sources is for identification only and does not imply endorsement by the U.S. Department of Health and Human Services.

## Implementation of the Guideline

### Description of Implementation Strategy

An implementation strategy was not provided.

## Institute of Medicine (IOM) National Healthcare Quality Report Categories

### IOM Care Need

Staying Healthy

### IOM Domain

Effectiveness

Safety

## Identifying Information and Availability

### Bibliographic Source(s)

O'Grady NP, Alexander M, Burns LA, Dellinger EP, Garland J, Heard SO, Lipsett PA, Masur H, Mermel LA, Pearson ML, Raad II, Randolph A, Rupp ME, Saint S, Healthcare Infection Control Practices Advisory Committee (HICPAC). Guidelines for the prevention of intravascular catheter-related infections, 2011. Atlanta (GA): Centers for Disease Control and Prevention (CDC); 2011. 83 p. [370 references]

### Adaptation

Not applicable: The guideline was not adapted from another source.

### Date Released

1996 (revised 2011)

## Guideline Developer(s)

American Academy of Pediatrics - Medical Specialty Society

American College of Chest Physicians - Medical Specialty Society

American Society for Parenteral and Enteral Nutrition - Professional Association

American Society of Critical Care Anesthesiologists - Professional Association

American Thoracic Society - Medical Specialty Society

Association for Professionals in Infection Control and Epidemiology, Inc. - Professional Association

Centers for Disease Control and Prevention - Federal Government Agency [U.S.]

Infectious Diseases Society of America - Medical Specialty Society

Infusion Nurses Society - Professional Association

Oncology Nursing Society - Professional Association

Pediatric Infectious Diseases Society - Medical Specialty Society

Society for Healthcare Epidemiology of America - Professional Association

Society of Critical Care Medicine - Professional Association

Society of Interventional Radiology - Medical Specialty Society

Surgical Infection Society - Professional Association

## Guideline Developer Comment

This report was prepared by a working group comprising members from professional organizations representing the disciplines of critical care medicine, infectious diseases, healthcare infection control, surgery, anesthesiology, interventional radiology, pulmonary medicine, pediatric medicine, and nursing. The working group was led by the Society of Critical Care Medicine (SCCM), in collaboration with the Infectious Diseases Society of America (IDSA), Society for Healthcare Epidemiology of America (SHEA), Surgical Infection Society (SIS), American College of Chest Physicians (ACCP), American Thoracic Society (ATS), American Society of Critical Care Anesthesiologists (ASCCA), Association for Professionals in Infection Control and Epidemiology (APIC), Infusion Nurses Society (INS), Oncology Nursing Society (ONS), American Society for Parenteral and Enteral Nutrition (ASPEN), Society of Interventional Radiology (SIR), American Academy of Pediatrics (AAP), Pediatric Infectious Diseases Society (PIDS), and the Healthcare Infection Control Practices Advisory Committee (HICPAC) of the Centers for Disease Control and Prevention (CDC).

## Source(s) of Funding

United States Government

## Guideline Committee

Healthcare Infection Control Practices Advisory Committee

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## Financial Disclosures/Conflicts of Interest

N.P.O.'G. served as a board member for the ABIM Subspecialty Board for Critical Care Medicine. M.A. is an employee of the Infusion Nurses Society, honoraria from 3M, Becton Dickinson, Smiths Medical. L.A.B. is a consultant for Institute of Healthcare Improvement; board membership for Theradoc, Medline; honoraria from APIC, Clorox. E.P.D. consulting from Merck, Baxter, Ortho-McNeil, Targanta, Schering-Plough, Optimer, Cadence, Cardinal, BDGeneOhm, WebEx, Cerebrio, and Tyco; grant support through the NIH; payment for lecture from Merck; payment for development of educational presentation from Medscape; travel and meeting expenses paid for by ASHP, IDSA, ASM, American College of Surgeons, NQF, SHEA/CDC, HHS, Trauma Shock Inflammation and Sepsis Meeting (Munich), University of Minnesota. J.G. honoraria from Ethicon. S.O.H. provides research support from Angiotech; honoraria from Angiotech, Merck. L.A.M provides research support from Astellas, Theravance, Pfizer; consulting for Ash Access, Cadence, CorMedix, Catheter Connections, Carefusion, Sage, Bard, Teleflex; payment for manuscript preparation from Catheter Connections. I.I.R. provides research support from Cubist, Enzon, and Basilea; consulting for Clorox; stock equity or options in Great Lakes Pharmaceuticals and Inventive Protocol; Speakers Bureau for Cook, Inc.; royalty income (patents owned by MD Anderson on which Dr. Raad is an inventor: American Medical Systems, Cook, Inc., Cook urological, Teleflex, TyRx, Medtronic, Biomet, Great Lakes Pharmaceuticals. A.R. consulting income from Eisai Pharmaceuticals, Discovery Laboratories. M.E.R. provides research support from Molnlycke, Cardinal Healthcare Foundation, Sanofi-Pasteur, 3M, and Cubist; consulting from Semprus; honorarium for lectures from 3M, Carefusion, Baxter and Becton Dickinson; previously served on Board of Directors for Society for Healthcare Epidemiology of America. All other authors: no conflicts.

## Guideline Status

This is the current release of the guideline.

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## Guideline Availability

Electronic copies: Available from the Centers for Disease Control and Prevention (CDC) Web site [REDACTED].

Print copies: Available from the Centers for Disease Control and Prevention, MMWR, Atlanta, GA 30333. Additional copies can be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-9325; (202) 783-3238.

## Availability of Companion Documents

None available

## Patient Resources

None available

## NGC Status

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